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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/682,900	10/31/2001	William Steven Lanier	59589.000004	2925

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EXAMINER

SODERQUIST, ARLEN

ART UNIT PAPER NUMBER

1743

DATE MAILED: 01/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/682,900

Applicant(s)

LANIER ET AL.

Examiner

Arlen Soderquist

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 10 November 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-19, 21-27 and 29-34 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-19, 21-27 and 29-34 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

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1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

2. Claims 1-19, 21-27 and 29-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Heyman (newly cited and applied) in view of Yokoyama (newly cited and applied), Jacquot, Burrows (US 5,739,038) and Yamaki (US 4,073,866) or Hara (JP 53-37591). In the paper Heyman discusses some considerations in determining oxides of nitrogen in stack gases by chemiluminescence analyzer. Federal regulations require the continuous monitoring of NO<sub>x</sub> in emissions from fossil fuel-fired steam generators and HNO<sub>3</sub> plants. Chemiluminescence analyzers are being used for this purpose. These analyzers contain a reaction chamber for the reaction of O<sub>3</sub> and NO<sub>x</sub>, a sensitive photomultiplier tube used to detect the radiation produced in this reaction, a source of O<sub>3</sub> and a NO<sub>2</sub>-to-NO converter. Sample handling requirements are specific for each installation. Requirements for the total analytical system are discussed. Wet and dry basis analyses are considered and potential interference from CO, H<sub>2</sub>O, NH<sub>3</sub> and SO<sub>2</sub> are evaluated. Page 210 discusses some of the principles of the chemiluminescent analyzer measurement and the requirements of stack gas NO<sub>x</sub> monitoring systems. Relevant to the instant claims is the possibility of an NO<sub>x</sub> only measurement or the determination of individual compounds with two separate measurements. Figure 1 shows a schematic of the analyzer including an ozone generator, an NO<sub>2</sub>-to-NO converter, a reaction chamber and a photomultiplier tube with the necessary flow meters, pressure controller and solenoid valves. The page teaches that the extractive NO<sub>x</sub> monitoring system usually includes a sample conditioning portion and

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the analyzer portion. The sample conditioning system is required to provide a representative sample of the stack gas at a proper pressure and flow rate, remove particulates to a level that will not affect the analyzer performance, adjust the water vapor concentration to a level that it will not condense in the analyzer, remove acid mists and provide calibration gas introduction. The page also gives some characteristics of the two types of stack gases exemplified and the requirements for the analyzer portion. Of the two types of stack gases exemplified the fossil fuel combustion process stack gas section is particularly relevant to the instant claims. Starting on page 210 the requirements for this type of system and various system components are given. The requirements include remove water vapor to a dewpoint well below that of the operating temperature of the analyzer, remove particulates to a size less than 1  $\mu$ , provide the sample at a proper pressure and flow rate and provide for calibration gas introduction. Figure 2 shows one form of the sample conditioning system. The system includes an external heated filter, a water vapor removal means and a pump. Figure 2 clearly shows the components are contained within an enclosure maintained above the sample dewpoint temperature. Figure 3 shows the combustion stack gas sample system assembly. For each of the above components, a preferred component type is given with alternate embodiments. For water vapor removal, a permeation distillation type drier capable of drying the gas to a dewpoint of  $-18^{\circ}\text{C}$  was used. NO was not removed from the gas by this type of drier, but some  $\text{NO}_2$  was removed with the water. Refrigerated condensers were taught as alternative means for removing water. It was noted that this drier type will remove all  $\text{NO}_2$  from the gas. Both downscale and upscale calibration gases are introduced into the sample conditioning system and may also be introduced directly into the analyzer to check for malfunction of the sampling system. Figure 2 shows span gas and instrument air as the calibration gases connected to the system. The sample system that is shown in figure 3 is normally designed for location at the stack, but can also be provided with temperature controlled heat-traced sample line for location adjacent to the analyzer when location at the stack is not feasible. Heyman does not teach the converter prior to or upstream of the drier, the type of catalyst used in the converter or analysis of additional gases.

In the paper Yokoyama teaches an improved method for determining the concentration of nitrogen oxides in exhaust gases. In determining the concentration of  $\text{NO}_x$ , i.e.  $\text{NO} + \text{NO}_2$ , in flue gases from boilers by the chemiluminescent method, the gas was contacted at the sampling

port with activated carbon at 240-300° to reduce NO<sub>2</sub> to NO, thus avoiding errors due to absorption of NO<sub>2</sub> by water condensed in the sampling line and the moisture eliminator. The original concentration of NO was determined after removing NO<sub>2</sub> at the sampling port by contact with an aqueous solution (pH 5-7) of Na<sub>2</sub>SO<sub>3</sub> (10 weight%) containing CuCl<sub>2</sub> (0.1M) and NaCl (3 weight%). The English abstract at the beginning of the paper identifies that when applied online, this analyzer usually gives a measurement of NO<sub>x</sub> that is low and a measurement of NO that is high. The source of this error was traced to NO<sub>2</sub> absorbed into water condensed in the sampling line and moisture eliminator of the analyzer and NO evolved from the water (see table 1). The reduced NO<sub>x</sub> measurement error was reduced by letting the gas flow through an activated carbon NO<sub>2</sub>-to-NO converter provided at the sampling point (see table 2 for the converter performance).

In the paper Jacquot discusses quantification testing of an infrared analyzer system for sulfur dioxide and nitric oxide in power plant stack gas. A description is given of a field qualification test carried out to determine application suitability of an analysis sampling system for the measurement of SO<sub>2</sub> and NO in coal-fired power plant stack gas. The qualification test was carried out as a result of operational problems experienced with the original system shown in figure 1. After modification to the system of figure 2, the system was operated for approximately 6 weeks during which time daily comparisons were made between analyzer readings and wet chemical determinations for SO<sub>2</sub> and NO. Overall agreement was >5% on the average (relative to the laboratory results) and >11% at the 95% confidence level. Analyzer stability (drift) was found to average <1% of full scale/day; the 95% confidence level extremes were <5% of full scale/day. The effects of several sample conditioning parameters were evaluated such as adsorption in sample lines and filter; cooling and condensing; interference by water vapor and CO<sub>2</sub>. All were found to have an insignificant effect on the analysis within the accuracy observed. The modified sampling-analysis system was suitable as a process monitor for SO<sub>2</sub> and NO in power plant stack gases. The system of figure 2 shows a sampling device positioned and configured to extract a sample from the stack, a filter positioned adjacent to the stack, a heated sampling line providing fluid communication between the sampling device and the filter, a refrigerated condenser for removing water from the sample located adjacent to and downstream of the filter and at least one analyzer in fluid communication with the gas sampling

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line located down stream of the refrigerated condenser. Relative to the chamber language of the claim, the description on page 2, right column, 7<sup>th</sup> paragraph teaches that the filter is housed in an electrically heated box that is kept above the sample dew point which would constitute a heated chamber. Relative to the adjacent to language of the claims, the legend for figure 2 indicates that the sample line is electrically heated and insulated for a length of about 50 feet or a length that would have been considered adjacent to or proximate to by one of skill in the art. The device also has means to provide span gases for calibration of the device. Relative to the heating of things such as the sample line, page 9, right column teaches that the types of stainless steel used will resist corrosion by the sample when heated to at least above the sample dew point.

In the patent Burrows teaches a spectrometer gas analyzer system to monitor emission of environmental gases such as nitrogen oxides from industrial processes. Column 9, line 48 to column 10, line 9 and column 12, lines 47-63 teach the use of full-scale span calibration of the analyzer.

In the patent Yamaki teaches a process for converting nitrogen dioxide into nitrogen monoxide in which a gas containing nitrogen dioxide is brought into contact at a temperature ranging from 50 °C to 400 °C with a carbide of a metal selected from the group consisting of chromium, molybdenum, tungsten, vanadium, titanium, tantalum, silicon and boron or a composite carbide of such metals, thereby reducing nitrogen dioxide contained in the gas to nitrogen monoxide. In the background section of column 1 Yamaki teaches that measurement of nitrogen oxides in an analyzer utilizing chemiluminescence is known. By the use of this analyzer, the concentration of nitrogen monoxide contained in environmental atmosphere or exhaust from apparatus can be measured precisely. For analysis of nitrogen dioxide, however, the analyzer necessitates the use of a converter capable of converting nitrogen dioxide into nitrogen monoxide. In the converter, carbon or a mixture of molybdenum oxide and carbon is used as reducing agent. However, a converter utilizing this reducing agent has as a drawback that it is effective only at high temperatures within a narrow range from 350 °C to 450 °C and these conditions apparently fail to make the conversion process efficient. Furthermore, there is an additional drawback that since the reducing agent used in this converter is influenced within such high temperature range by organonitrogen compounds such as peroxyacetyl nitrate and alkyl nitrates, it is impossible in the presence of such compounds to selectively and

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quantitatively convert nitrogen dioxide alone into nitrogen monoxide. The carbides of Yamaki are taught as being able to cause the selective conversion of nitrogen dioxide at a lower temperature. The tables and examples teach that the molybdenum carbide is capable of efficiently converting nitrogen dioxide to nitrogen monoxide.

In the published application Hara teaches the production of a catalyst for converting nitrogen dioxide into nitrogen monoxide. The catalyst is prepared by dissolving a water-soluble carbohydrate (sucrose, glucose, soluble starch, dextrin, etc.) and a water-soluble molybdenum (Mo) salt (Mo tetrachloride, Mo pentachloride, etc.) or a water-soluble molybdate (ammonium molybdate, etc.) in water. This is optionally followed by concentration; subjecting the concentrated aqueous solution to dry distillation under inert gas atmosphere ( $N_2$ , etc.) at 300-1,000 °C to carbonize the carbohydrate. Pulverizing the carbohydrate and mixing it with a carbohydrate-type binder (starch, sucrose, glucose, etc.) and a small amount of water, followed by forming it into a shape; calcining the product at 300-1,000 °C in an inert gas atmosphere; and heating the calcined product at preferably 400-800 °C in hydrogen to convert the Mo salt or molybdate into elementary molybdenum. The catalyst is capable of converting high rates of  $NO_2$  into NO, even at low temperatures, without being affected by the presence of  $NH_3$ .

It would have been obvious to one of ordinary skill in the art at the time the invention was made to place the  $NO_2$ -to-NO converter of Heyman in the sample conditioning system prior to the drier because as taught as taught by Yokoyama the positioning of the converter at the sampling position reduces errors recognized by both Heyman and Yokoyama due to the removal of  $NO_2$  in the drying process. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the activated carbon of Yokoyama or the catalysts of Hara or Yamaki in the  $NO_2$ -to-NO converter as taught by Yokoyama because of its ability to perform the conversion as taught by Hara, Yamaki and Yokoyama or the ability to reduce the conversion temperature and efficiency as taught by Hara and/or Yamaki. If Heyman does not already teach the limitations related to the addition of span gas, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the span gas device and process as taught by Jacquot or Burrows into the Heyman apparatus and method for their recognized ability to calibrate the measurement process. It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the measurement of additional gases and the

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separate analyzer room as taught by Jacquot into the Heyman apparatus for the ability of further characterizing the exhaust or flue gases as shown by Jacquot.

3. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection. The newly cited and applied Heyman reference appears to describe a system and method that is equivalent to or described in greater detail than the prior art of instant figure 1. Heyman also recognizes that the removal of nitrogen dioxide in the drier occurs and can be a problem depending on the type of drier and the nitrogen dioxide concentration. The Yokoyama reference deals with this problem and solves it by placing the NO<sub>2</sub>-to-NO converter at the sampling point so that it is prior to the drier (moisture eliminator). This provides clear motivation to shift the NO<sub>2</sub>-to-NO converter in the Heyman device from the analyzer portion to the sampling system to reduce or eliminate the recognized problem of nitrogen dioxide removal in the drier.

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The additionally cited art relates to measurement of stack or flue gases from industrial processes.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Arlen Soderquist whose current telephone number is (571) 272-1265. The examiner's schedule is variable between the hours of about 6:30 AM to about 5:00 PM on Monday through Thursday and alternate Fridays.

A general phone number for the organization to which this application is assigned is (571) 272-1700. The fax phone number to file official papers for this application or proceeding is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



January 6, 2005

ARLEN SODERQUIST  
PRIMARY EXAMINER